



LASER STRUCTURING AND LASER CUTTING OF SOLID-STATE BATTERIES

Task

Solid-state lithium-ion batteries (SSLB) consist of different solid layers, only a few micrometers thick, thereby reducing the overall thickness of the battery to less than 1 millimeter. When individual cells are detached from large area battery substrates, no electrical connection may be formed between the layers. In conventional laser-based cutting, material is melted and expelled from the kerf. For sensitive layers, such as those within a thin-film battery, this is not allowed since a connection can be formed between the individual battery layers during the melting and re-solidification. The use of laser-based ultrafast processes under inert gas atmosphere makes this processing task possible.

Method

Laser beam sources with ultra-short pulses can be used to prevent melt from forming and, thus, a short-circuit from occurring. In addition, the battery layers can be removed by an upstream, selective structuring process around the kerf, which minimizes the risk of short circuits. Likewise, functional elements such as contact surfaces can be produced by selective laser ablation.

Result

For the selective structuring and fabrication of thin-film batteries, a processing system was set up, in which the laser processing is conducted by ultrashort pulsed lasers under an inert atmosphere. This makes it possible to process even highly reactive coating systems. When galvanometer and axle systems are used, the process is also geometrically flexible.

Applications

The know-how gained from the thin-film battery manufacturing can be applied to the manufacture of flexible OLED displays, electronic circuits and on organic and perovskite solar cells.

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- 2 Laser patterning and cutting of an SSLB (solid state lithium battery).
- 3 SSLB fabricated with a laser.